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360° Spherical Photography

FBI Field Photographer's Guide





360° Spherical Photography

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360° Spherical Photography

EQUIPMENT ID & SETUP

At the very least, you will need the following assigned equipment:

- Nikon D700
- Gitzo tripod
- Nodal Ninja
- Nikon 10.5mm lens with R1 ring clamp (attached)
- Nikon Speedlight strobe unit (SB-800 or SB-900)
- Remote or wireless trigger (not required, but useful)

WHY DON'T WE USE THE D800?

While the D800 is more than adequate for crime scene work, it is recommended that the D700 is used to capture spherical imagery. With the D800, file sizes are extremely large, taking much longer to download, post-process and stitch.

Spherical imagery should always be considered as a general overview of the scene and is not intended to provide images with a forensic value.

CAMERA SETTINGS

Before mounting the camera/lens to the tripod, make sure camera settings are correct for 360° shooting.

Set the camera in Manual Mode for exposure. The focus switch should be in the Manual (M) position. The Metering Selector switch should be set to Center-Weighted.

The 10.5 mm lens should be focused so that the infinity marker on the distance scale (∞) is placed above the $f/8$ depth-of-field indicator as shown in the image below. This allows for the greatest area of acceptable focus from less than 2 feet to infinity. The focus ring should then be locked in place. Using a small piece of electrical tape to secure the focus ring helps avoid accidental movement.



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CAMERA SETTINGS (continued)

ISO: Use lowest possible for lighting conditions. 200-400 recommended for outdoors, 200 - 1600 for indoors.

APERTURE: **Optimum range is f8 to f16** with a “sweet spot” around f11. With the 10.5 mm lens, apertures larger than f8 decrease depth of field and increase the possibility of vignetting. Stops smaller than f16 can introduce diffraction and will soften your image.

FILE NAMING: Since there may be more than one photographer on scene, using your initials will help you organize and keep track of your images. This will be explained in greater detail.

IMAGE QUALITY: RAW

IMAGE AREA: **Auto DX crop should be OFF**, choose the FX format (36 x 24).

NEF (RAW) recording: ON, with the NEF (RAW) bit depth set to 14-bit.

WHITE BALANCE: For RAW shooting, AUTO white balance works fine in most situations. A gray card or SpiderCube in one of the shots may help as well.

COLOR SPACE: Adobe RGB is the preferred setting for images that will be extensively processed and retouched.

ACTIVE D-LIGHTING: Auto or Normal, adjust as necessary.

VIGNETTE CONTROL: OFF

LONG EXPOSURE NR: OFF

HIGH ISO NR: OFF The sensor itself on the D700 does a pretty good job at making noise less noticeable. However, using this feature adds in-camera effects that may not be adjustable or removed later. You have much more noise reduction control in Lightroom.

MULTIPLE EXPOSURE: OFF

IMPORTANT SETTING!!!

In the Custom Setting Menu, scroll to item d6, FILE NUMBER SEQUENCE.

This should be set to ON and then reset once and ONLY once at the beginning of the mission. You will understand why this is so important later when we discuss organizing your images.

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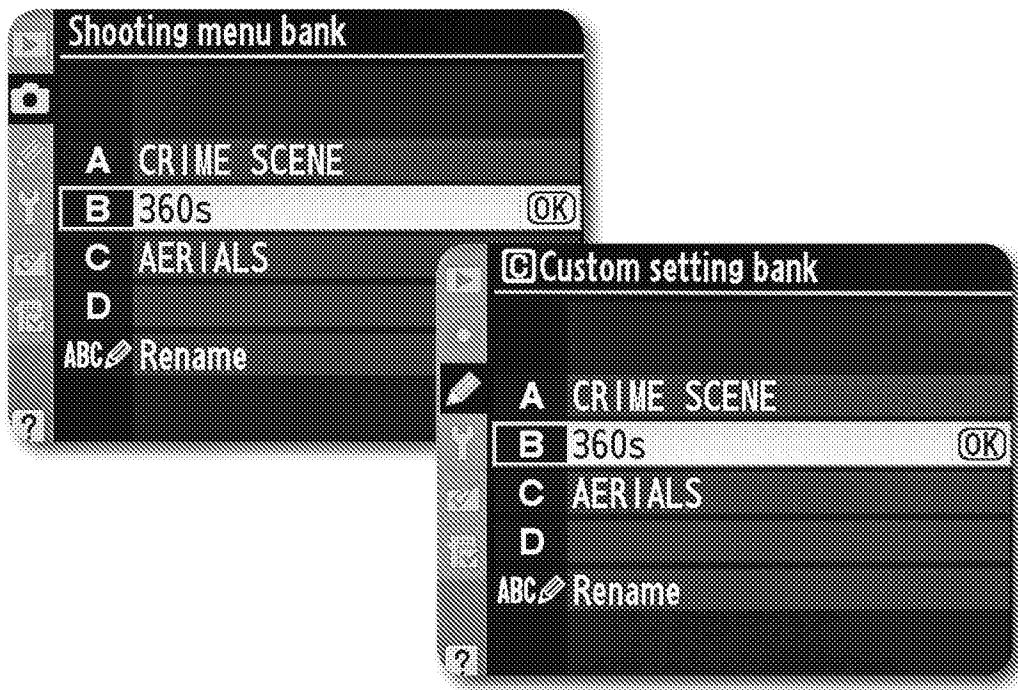


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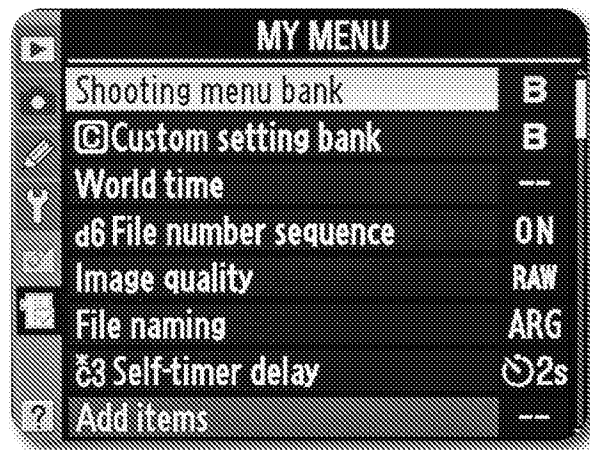
CAMERA SETTINGS (continued)

Once you have entered the required camera settings in your D700, it is extremely helpful and convenient to save these settings in their own Shooting Menu Bank and Custom Setting Bank.

Below are screen shot examples of how you might want to set up your own menu banks. Specific guidance on how to set up and name these banks is found in the D700 User's Manual. For the Shooting Menu Bank refer to pages 268-271 and for the Custom Setting Bank, see pages 280-282.



You can also customize commonly used settings by adding them to the “My Menu” checklist. By setting this up, you will have quick access to important menus like World Time and File Number Sequence. See page 364 in the D700 User's Manual for more guidance.



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MOUNTING THE CAMERA & LENS

After the lens is attached to the mount, slide the lens ring plate to the correct setting so that the camera body rotates around its No Parallax Point (NPP) or *nodal point*.

What is the *nodal point*? Technically speaking, it's the point where there should be no parallax effect due to the rotation of the camera on the tripod. This effect can create image distortion, making the images harder to stitch together. Even if the images do stitch, visible seams or ghosting may appear in the final panorama.

You can eliminate this by properly positioning the lens on the Nodal Ninja. *For our equipment, the manufacturer has determined that users align the lens ring plate on the quick release mount at 1.65cm. HOWEVER, you should go through the calibration process to verify the correct setting for your lens mount.*



The lines on the mount are very small and close together so extra light and/or a magnification device may be necessary for proper alignment.

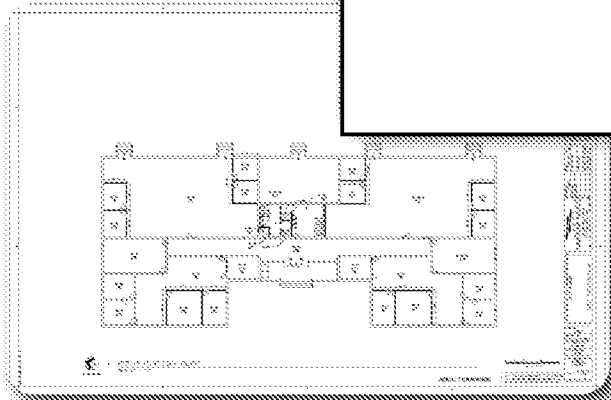
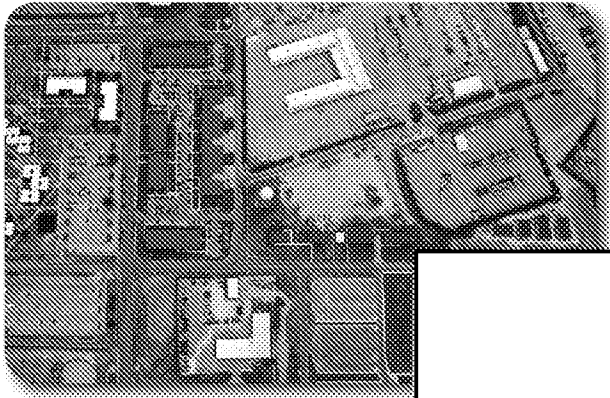
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SHOOTING

Whether you are performing a site survey or documenting a crime scene, the main thing you need to be aware of is what area(s) you are going to cover. Having a map, floorplan, blueprints or even a rough ERT sketch can help you determine where your shot locations are going to be. These items will also supplement your photo log and allow you - or anyone else documenting/reconstructing the scene - to determine the exact location of the images.



For each location you need to take at least 6 shots - 0°, 60°, 120°, 180°, 240°, and 300°. An additional photo can be taken (a repeat of the first 0° shot) to “bookend” your series. Placing your hand or object such as a grey card in front of the lens will also help identify the end/beginning of a series.



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Remember, while Aperture Priority may be used, for the best and most consistent results, Manual mode is recommended. The important point is this: during a series of images, DO NOT change the aperture setting. Change only the shutter speed to adjust your exposure.

Additional shooting tips:

- Using a cable release, self-timer or wireless remote will minimize camera shake. In situations where there are long shadows or lots of reflections, the self-timer/remote can also give you time to get out of your own way!
- Adjusting your tripod legs so they are out of view can make for a cleaner looking image. This technique, however, is not recommended in windy conditions or on uneven surfaces.
- Choosing your 360 locations depends on the coverage you need/desire. For a long stretch of road or sidewalk, you may find that every 50 feet will suffice. However, in a concourse, hallway or small room, you may take several 360s within a few feet of each other. When possible, try to make sure each 360 location is within eyesight of another. You also want to make sure your focus includes areas of interest, like emergency exits, hallway intersections, equipment/electrical/mechanical/HVAC rooms, etc.
- Scan the entire field of view before you setup and shoot. Consider the following questions:
 - Will you be stuck in a corner?
 - Are there objects that may create unwanted shadows or block your view?
 - Are there people/vehicles that you will be unable to mask out later?
 - Is there a lot of symmetry and/or lack of detail in the scene?

- Completing an FD-674 Photo Log in addition to placing your 360 locations on a map/diagram will help you (or someone else) recall what images were taken and the locations. While the detail of an "ERT" Photo log is not necessary, you should always include the image file numbers and the spot location number.

- Transfer/backup your images daily if necessary to a DVD, external HD or other storage device such as a Hyperdrive Colorspace UDMA.

FD-674 (Rev. 5-18-2013)		PHOTOGRAPHIC
		GENERAL INFORMATION
DATE _____		
CASE ID _____		
LOCATION _____		
PREPARER/PHOTOGRAPHER _____		
REMARKS _____		
PHOTO #	DESCRIPTION OF PHOTOGRAPHIC SUBJECT	
1	PHOTO LOG	
2-8	SP1 ENTRANCE TO PKG GARAGE	
9-15	SP2 INSIDE PKG GARAGE	
16-22	SP3 PKG GARAGE	
23-29	SP4 PKG SPOT H227	

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WORKFLOW

There are three big steps to a good 360 workflow:

1. ORGANIZATION
2. ORGANIZATION and
3. ORGANIZATION.

Notice a theme?

This is key, especially when dealing with *several thousand* images for larger and/or more complex venues. As you can imagine, if you don't have a plan, it's going to be very difficult to stay focused.

Using an example from a site survey in New York, the next several pages will show the "big picture" of organizing your images. It's a good idea to have a system that not only makes sense to you, but also meets the needs of the people putting the final package together. In a project involving multiple photographers, it's important to maintain consistency in the naming structure of the final panoramas.

360 lesson disclaimer - Many might have a particular way of using Lightroom. Some may even prefer to work in Camera Raw. The steps used here might vary from photographer to photographer, but the final results should be the same among everybody.

One of the major strengths of using Lightroom is that you get the organization capability of Adobe Bridge combined with the processing ability of Camera Raw - all with one program. Strictly using Lightroom for organization, cataloging and processing all of your images will greatly reduce the amount of time spent getting the job done.

Another point...don't be overwhelmed by the seemingly complicated way this is laid out. It may seem daunting, especially with the way the process moves from Lightroom to PTGui, or Lightroom to Photoshop back to Lightroom to PTGui, etc. After you see it done and definitely after you've done it yourself a number of times it will become much easier.

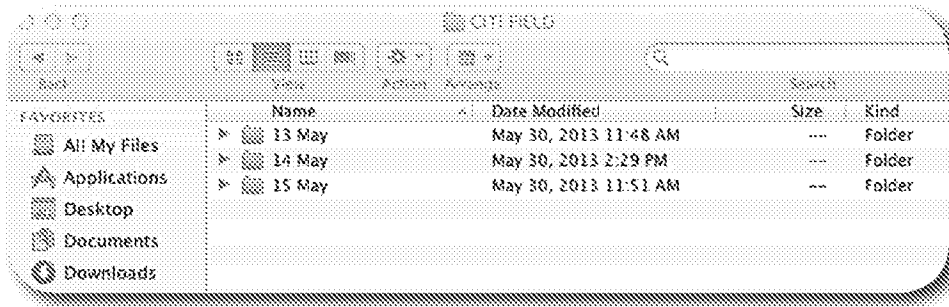
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ORGANIZING

The first thing to do is separate the images by date. In this example, three folders were created, one for each day of the survey.



ADDITIONAL FOLDERS:

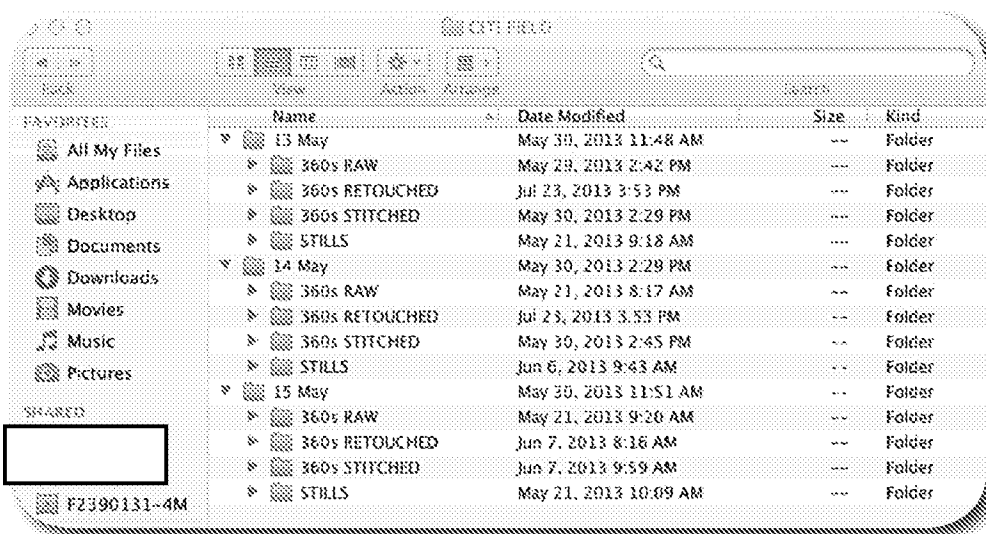
- **360s RAW:** This folder contains the RAW images straight from my camera, media card, DVD, external HD or backup device, etc. This is where you initially transfer all of your images.

The reason that the camera File Number Sequence is ON and RESET once at the beginning of the assignment helps here. Your first image should be:

“__(initials)0001.NEF”.

Even if a new memory card is used or formatted, the file numbers will keep increasing until the end. In other words, you won't have multiple images with the same file number.

- **360s RETOUCED:** After processing the images in Lightroom, export the images to this folder. This is where real separation starts to take place. From the photo logs and maps, you should know the location of each 360, so you can export the images into a more specific sub-folder.



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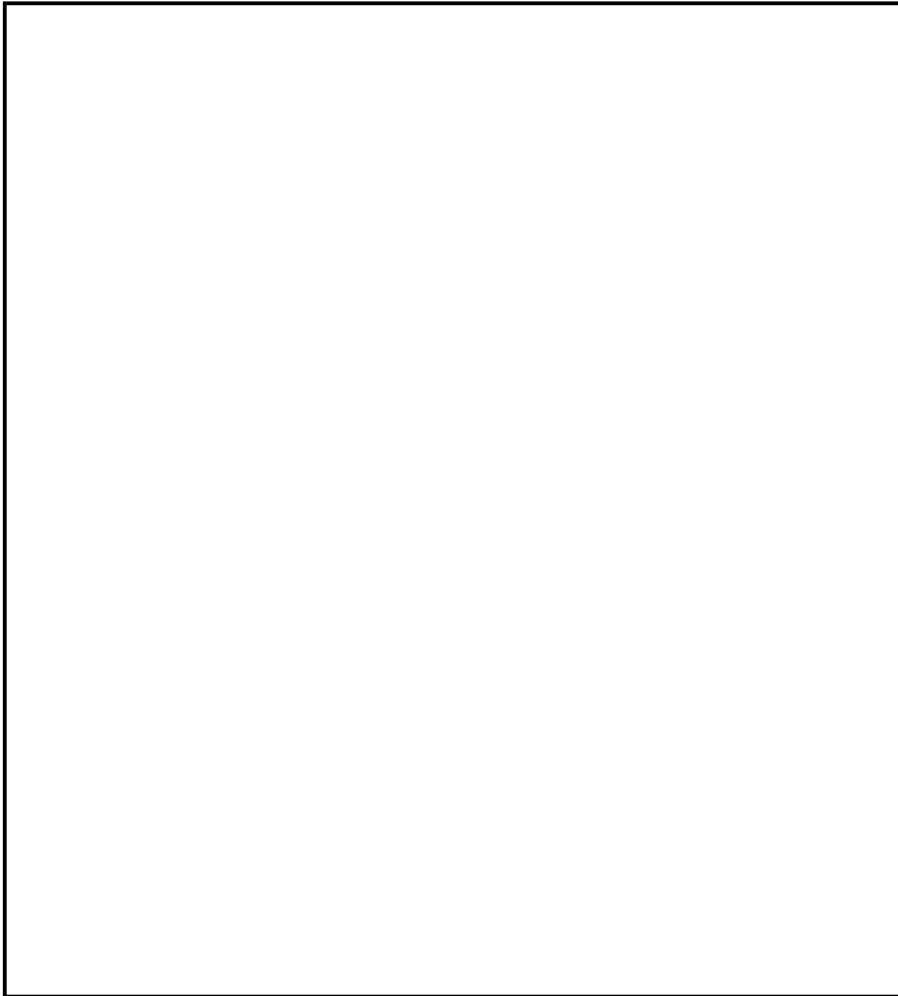
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In this example, notice the processed images for camera positions 76, 77 and 78. These files were directly exported from Lightroom into this sub-folder, "EMPIRE QUAD B."

Naming the files will be addressed in a bit...



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- **360s STITCHED:** This folder is the final degree of separation. It contains the same exact sub-folders as the RETOUCHE folder, but only contains the stitched images created in PTGui.
- **STILLS:** This folder contains any RAW still images (doors, trajectories, evidence, etc) for this date. Once processed, you can export the final JPGs directly into the appropriate "Stills" sub-folder, as mentioned in the previous paragraph.

Finding it easier to keep ALL imagery separated by location, additional processed still images for each level/floor/concourse, etc. were placed in this folder.

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PROCESSING IN LIGHTROOM

LIGHTROOM BE GONE!

To prevent Lightroom from opening every time you insert a memory card, do the following:

Under the Lightroom Menu, open the Preferences dialog box. In the General section, uncheck the box, "Show import dialog when a memory card is detected"

Step 1: In the Library Module, import your images from the 360s RAW folder.

Step 2: In the Develop Module, adjust your photos as necessary. For a majority of the images, you can pretty much work your way from top to bottom. Start with the first image in a series.

White Balance

Exposure

Contrast (increase slightly)

Highlights/Whites – decrease (recovery)

Shadows/Blacks – increase (fill light)

Clarity – increase slightly (change view to 1:1)

Vibrance/Saturation – as necessary

Noise Reduction – for most indoor locations, with an ISO of 800, 40-50 is a good start. Use judgment to avoid too much "softness". (change view to 1:1)

Lens Corrections – Color Tab, check "Remove Chromatic Aberration"

Once the 1st image in the series is complete, you can "Sync" that image with the other images in that location (or series of locations). Then review each one and make Tone adjustments as necessary. These adjustments are subjective and some images may need more "tweaking" than others.

The important thing to look for is continuity in color and exposure throughout each series of images.

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CREATING A USER PRESET (Sample starting point)

Set the following sliders:

Contrast - 20

Clarity - 20

Noise Reduction - 50

Lens Correction - "Remove Chromatic Aberration".

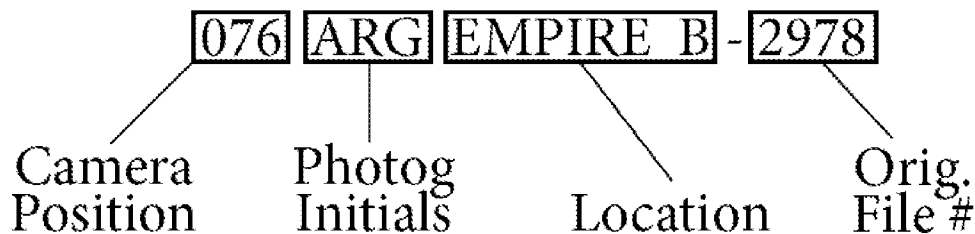
On the left hand panel, click the "+" on the Preset tab to Create New Preset. Once the dialog box opens, give it a name, make sure it goes in the "User Presets" folder, click "Create".

File Naming and Structure

Before exporting the images, here's a suggested method for naming the exported files.

All your RAW images should have the file name "_ (initials)(file number).NEF". For example, _ARG0001.NEF, _ARG0002.NEF, _ARG0003.NEF, etc.

When exporting Lightroom files, add information that will help identify where, and by whom, the photographs were taken.



At a quick glance, this naming convention provides an easy reference to identify the camera position (076), who the photographer was (ARG), the physical location within the venue (EMPIRE B), and the original file number.

The next paragraph explains the process.



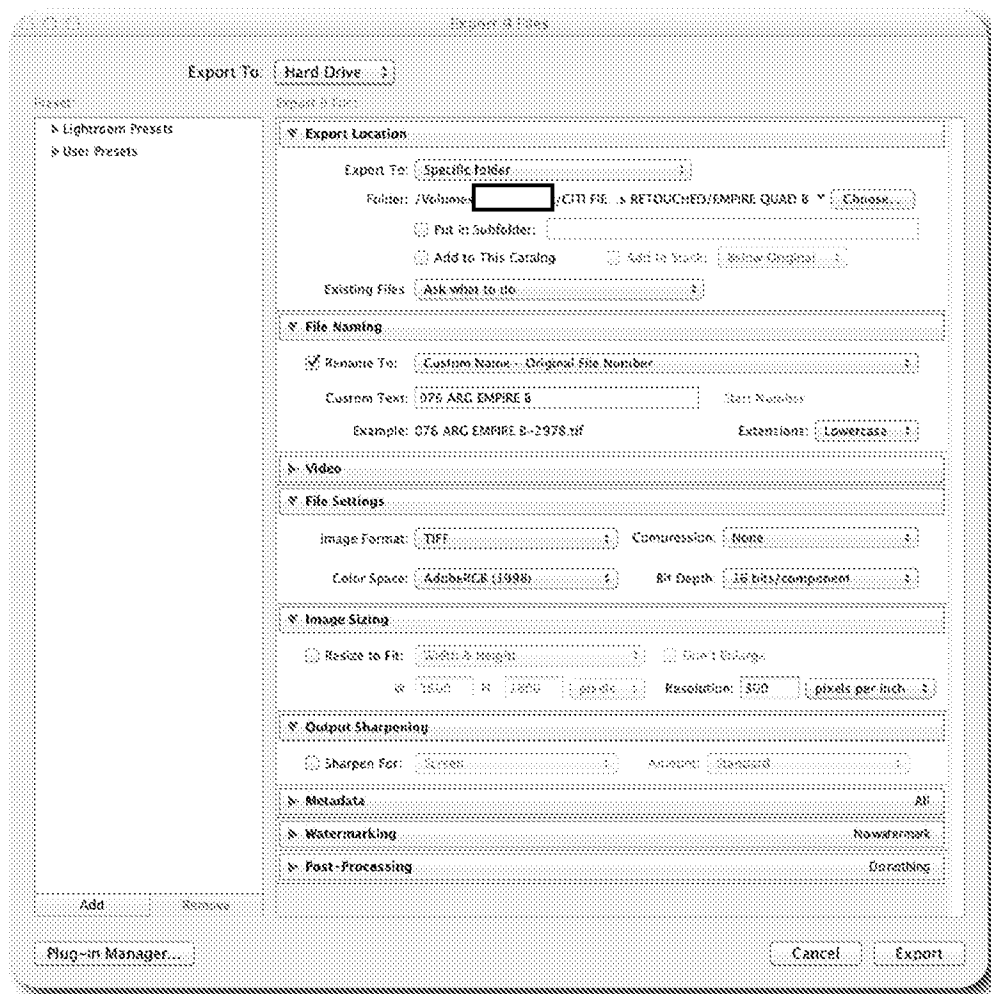
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Exporting Images

As mentioned before, once all the images have been processed, you can now begin to export each camera position (spot) into the appropriate sub-folder of the 360s RETOUCHE folder.

In the Library Module, select all the images from one position (spot). Remember, there must be at least 6 images per position. Click on the first image of the series, shift click on the last to highlight all of the images from that spot.

Click “Export”. In the dialog box, the settings should be as follows:



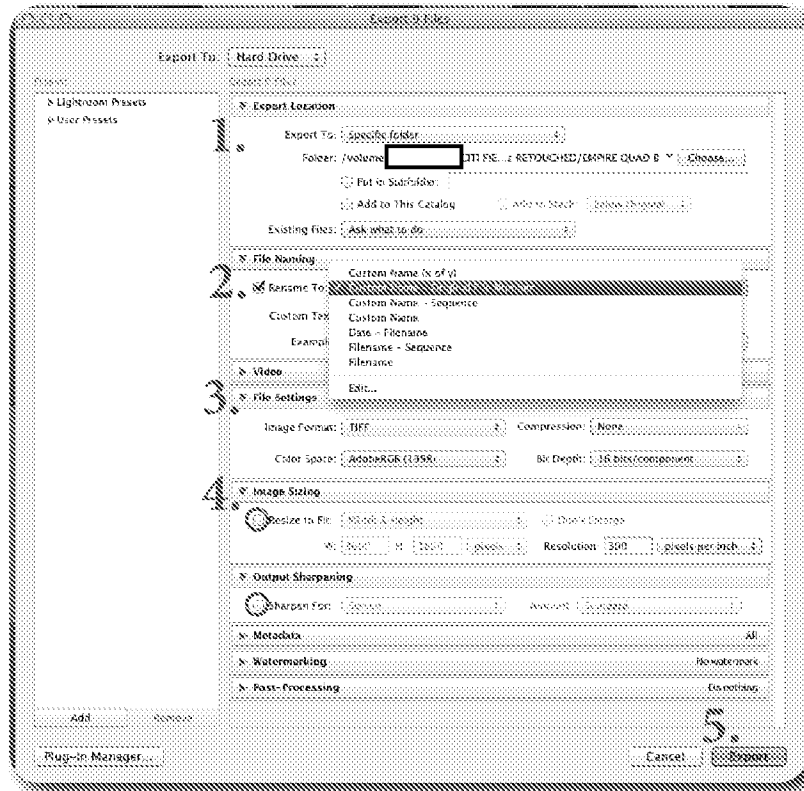
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1. Choose the appropriate **Export Location**. In this example, the specific folder is going to be the location where the 360s were taken (EMPIRE QUAD B). Again, this helps with organization.
2. In the **File Naming** dropdown box, choose "Custom name - Original File Number." Here is where you enter the filename information. It's spot 076, photographer's initials, and location. Lightroom adds the file number of the image. (See next screenshot)



3. **File Settings** should be TIFF, No Compression, AdobeRGB, 16 bits.
4. Leave settings in **Image Sizing** and **Sharpening** unchecked.
5. Click **Export** in the lower right corner of the dialog box and Lightroom will send all of the selected images to the chosen specific folder.

Repeat for the remaining images. The only thing you will have to change is the spot number. When you highlight the next series of images and export, the dialog box opens with all of the information you just entered. Just change the 076 to 077, then 078 and so on.

After working through this sequence a few times, you will see how quick this process will become.

NEXT - Working with images in PTGui.

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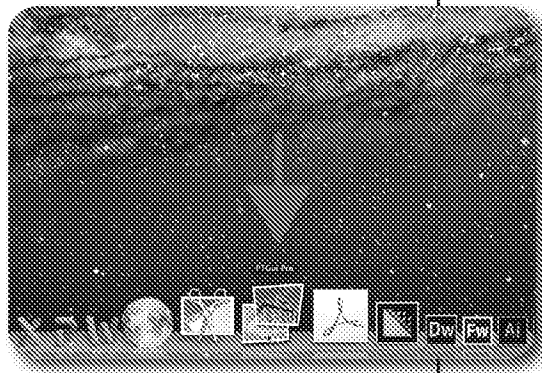
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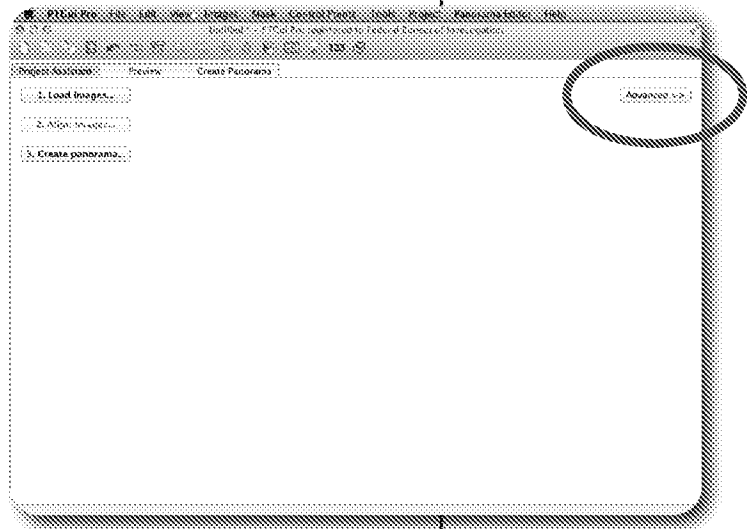
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OPENING PTGui

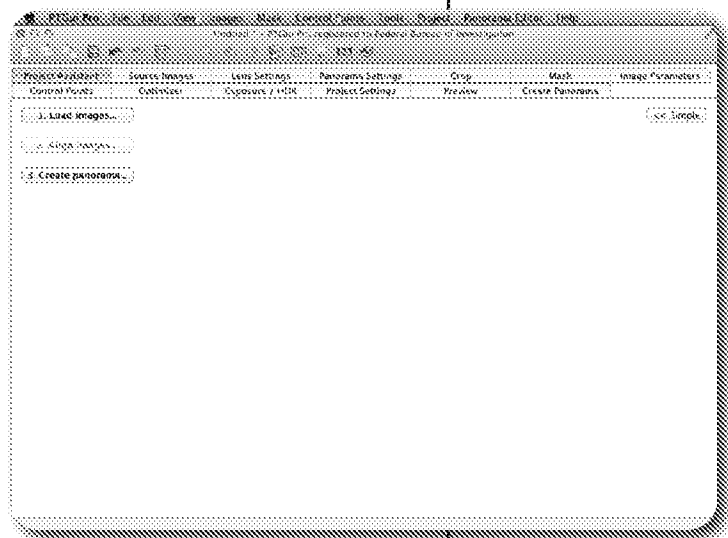
Click the PTGui icon that appears along the bottom of your desktop screen.



When the program opens, your screen may look something like this... If it does, click on the “Advanced” button in the upper right corner in order to open up all of the tabs.



Now your screen will look something like this:



You're all ready to go!

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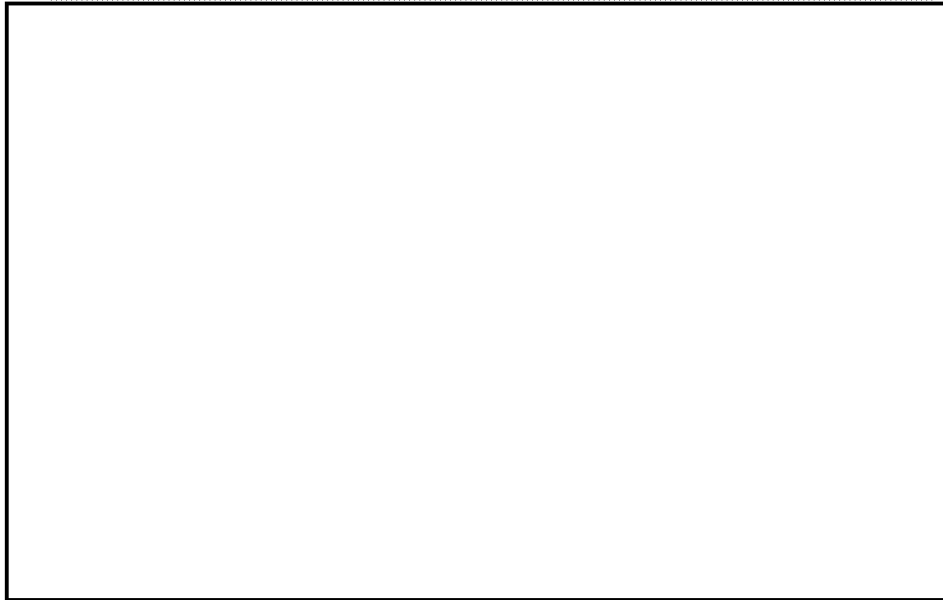


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STITCHING IMAGES IN PTGui

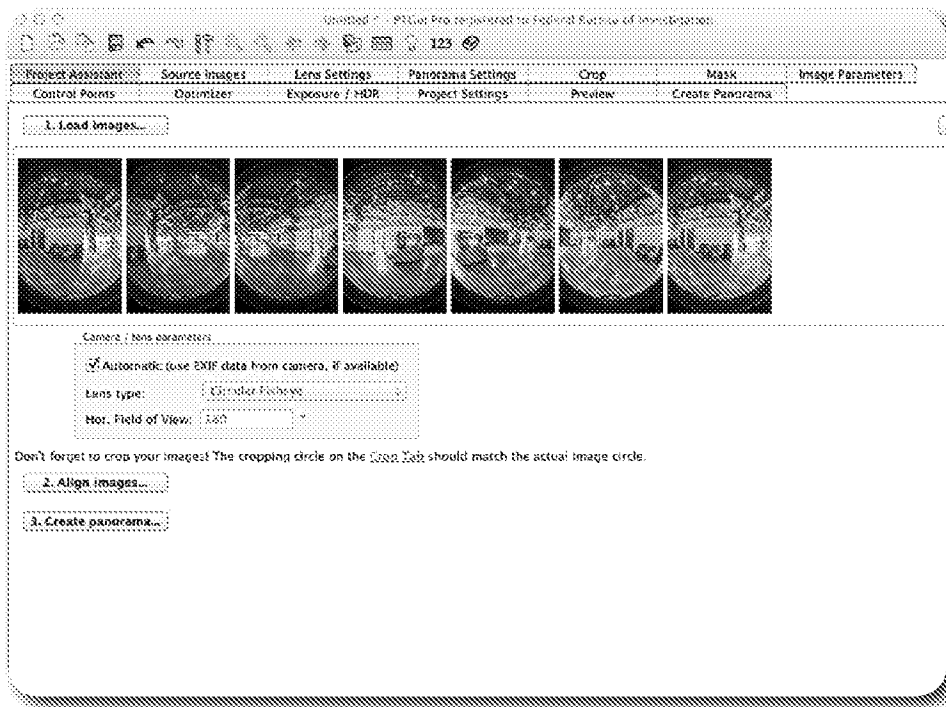
STEP ONE - LOAD IMAGES

Click the “Load Images” button. Navigate to the appropriate folder containing the RETOUCHE .tif images. Select all the images for the spot/location you want to stitch.



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The images will open sequentially as shown below.



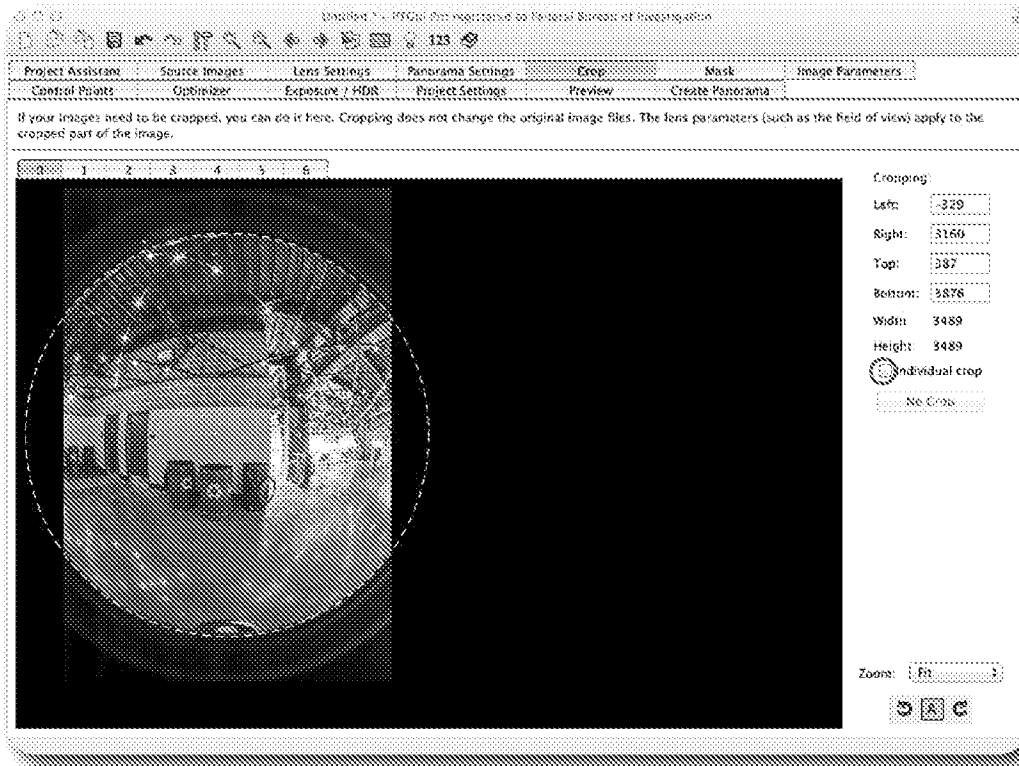
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STEP TWO - CROP

Click on the “Crop” tab at the top of the screen. Place the cursor on the dashed line. With your mouse, left click and hold to adjust the crop circle so the line corresponds to the top and bottom edges of the image area. It’s best to click onto the top and/or bottom of the dashed line and drag up or down to the image edge.



Make sure the “Individual crop” box on the right hand panel is unchecked. This ensures that the same crop area is applied to all of the images.

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STEP THREE (if necessary) - CHOOSE IMAGES

Click on the "Source Images" tab. In this example, the "bookend" technique was used and 7 shots were taken. Compare the 1st and last images, choosing the best one. Select and delete the other image.



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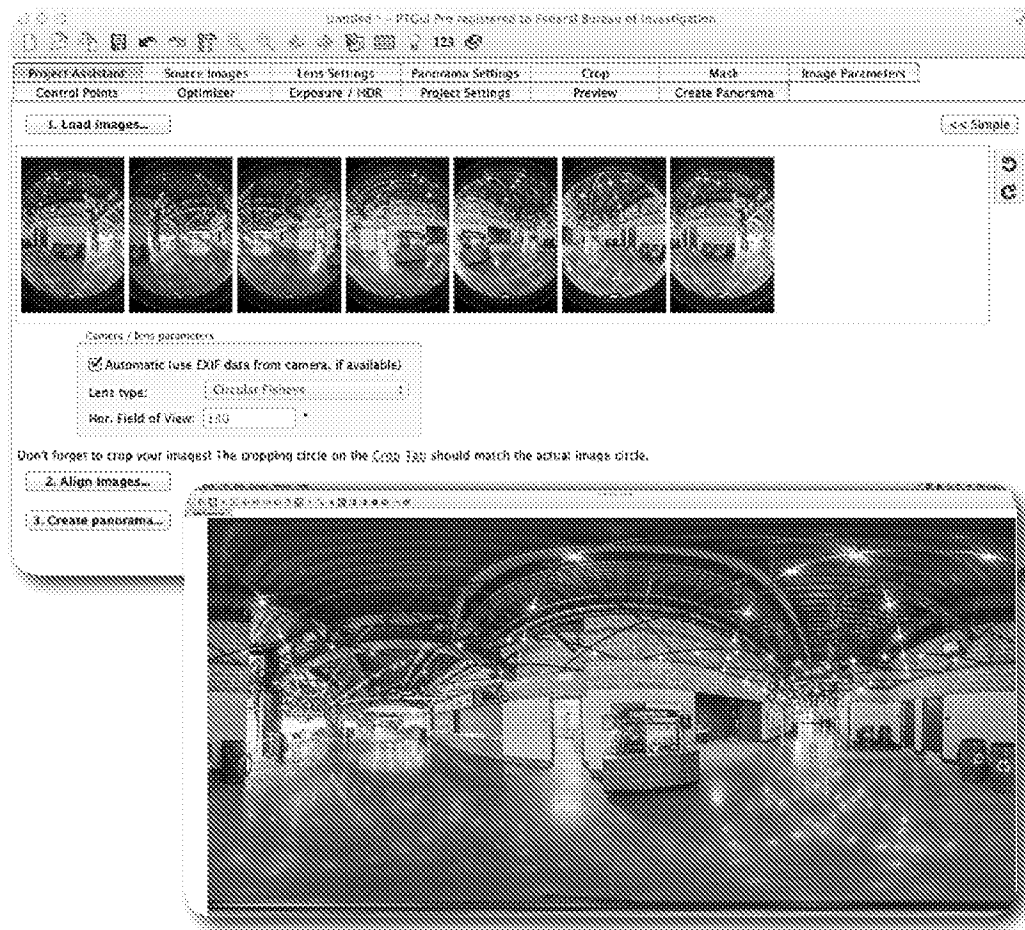


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STEP FOUR - ALIGN IMAGES

Go back to the “Project Assistant” tab and click on the “Align Images” button. The images will stitch together in a low resolution version in the Panorama Editor.

The distortion is normal since you are looking at a flattened view of a 360° image. Check for proper stitching, look for any seams and/or sections that look out of place.



If the images are out of alignment, return to the Project Assistant tab and click on “Align images” button. It has been observed that this procedure usually corrects most alignment issues.

Once the image is reviewed, close the Panorama Editor window. You will return to the Project Assistant section.



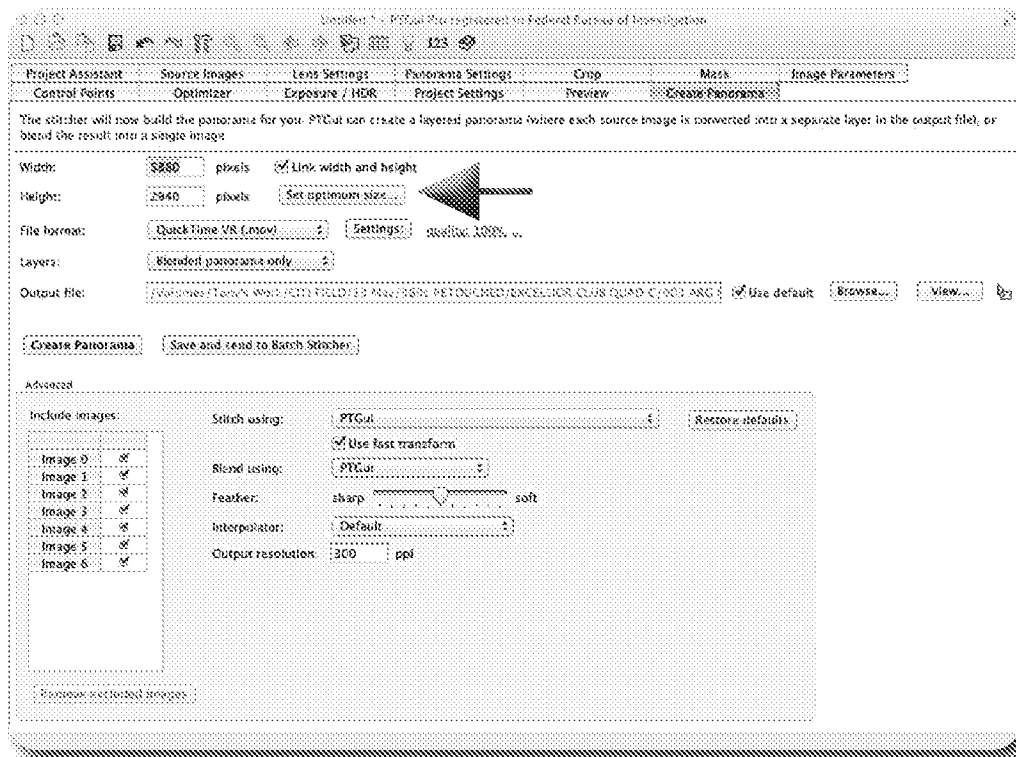
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STEP FIVE - CREATING AN INTERACTIVE PANORAMIC IMAGE

Click on the “Create Panorama” button or the tab along the top.

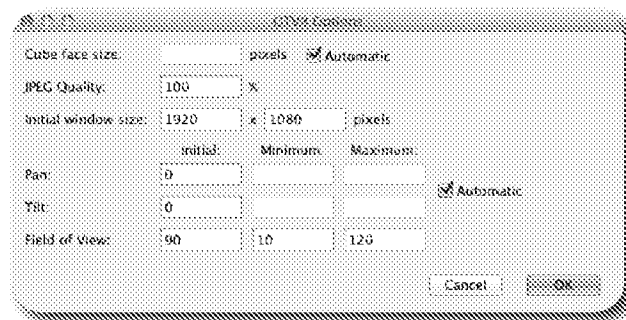
The default settings will suffice for this exercise (see screenshot below). Pixel width and height values may be different depending on the size/crop of the image.

Click on the “Set optimum size” button to ensure that “Maximum size (no loss of detail)” is selected.



Click on the File format dropdown box and select “QuickTime VR (.mov)”.

Adjust the .mov output options as desired by clicking on the “Settings” box. JPEG Quality should be at least 80% with an Initial window size of at least 800x600 pixels.



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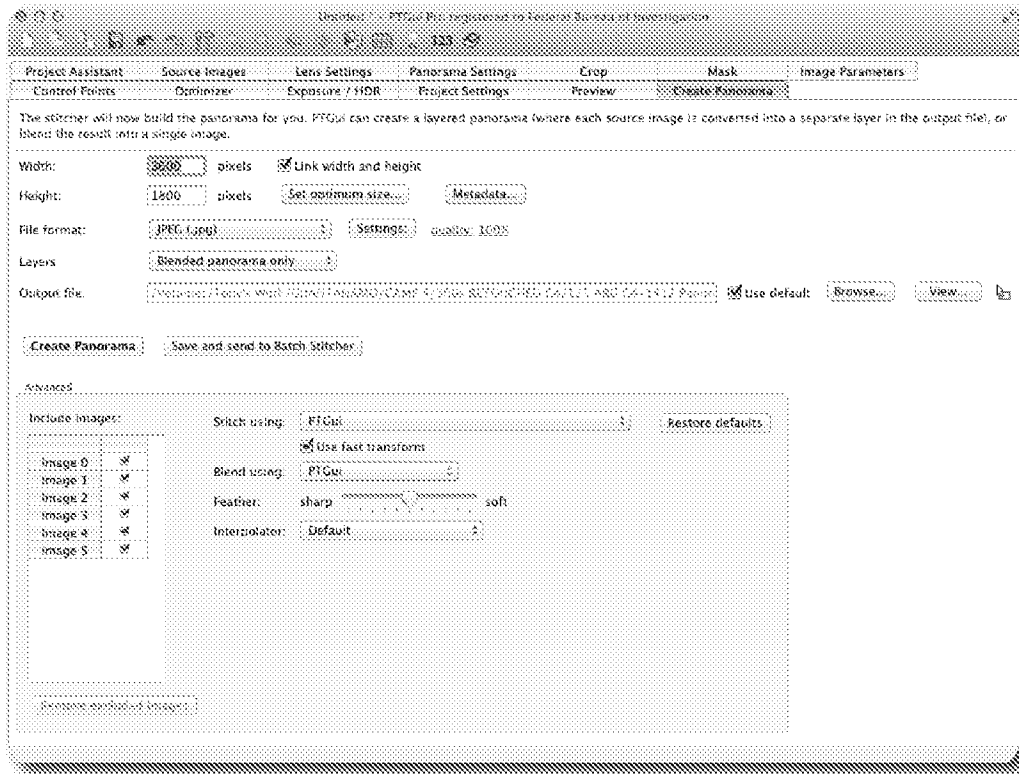
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By default, PTGui will create and send your Panorama Output file to the same folder where the original images reside. Leave the “Use default” box checked for now so you know where they are.

Click the “Create Panorama” button to complete the stitching process.

NOTE: If a .jpg image is desired, and to avoid having file sizes that are too large - perform the same steps using the following recommended settings:

Width: 3600
Height: 1800
Quality: 90%



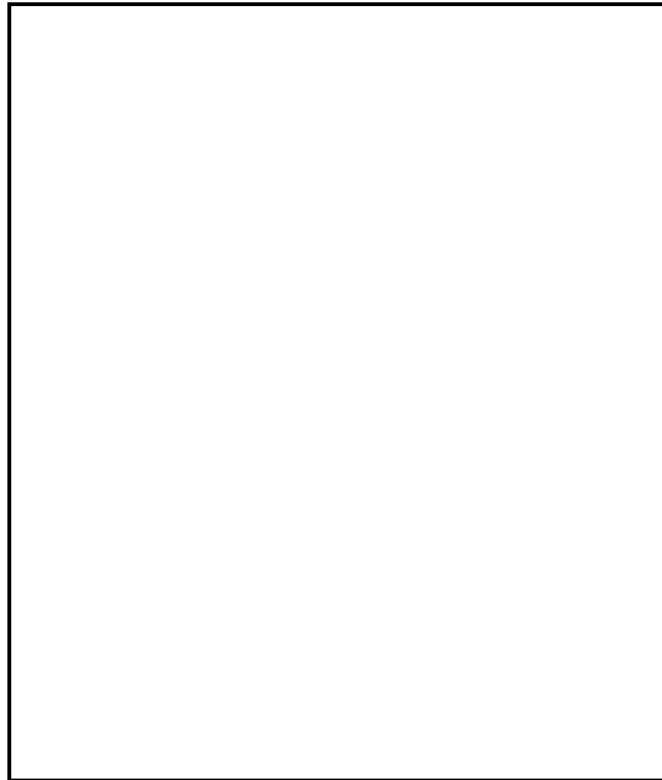
Click “Create Panorama” and PTGui will stitch together a flattened version using the same filename, except it will have a .jpg extension.



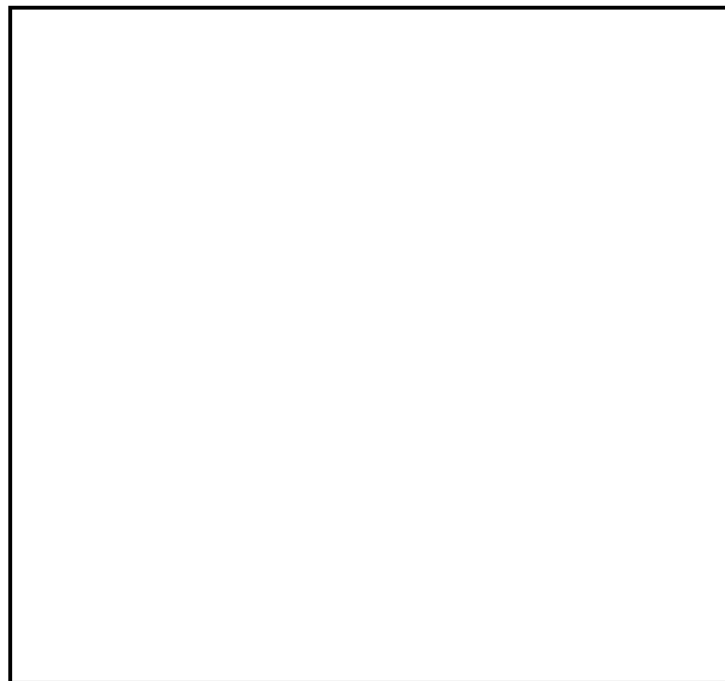
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FINAL IMAGE FILE SEPARATION

Your “360s RETOUCHE” folder will now look something like this:



Click on “Kind” to sort the images. Then select, cut and paste all Panorama images from this folder into your “360s STITCHED” folder.



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ADVANCED PTGui TECHNIQUES

MASKING

Simple example - people, vehicles

HDR/BRACKETING

Example #1 - Bracketed shots

Example #2 - Masking

Example #3 - Lightroom/Photoshop/Lightroom

MANUALLY ADDING/REMOVING CONTROL POINTS

Examples of where - arena, hallway, locker room

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ADDITIONAL NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

ADDITIONAL NOTES

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.